

CHAPTER 7 (C)

TACTICAL CONTROL

Section I (C). PRINCIPLES OF TACTICAL CONTROL

58 (U). General

To provide the most efficient control and operation of the Improved NIKE-HERCULES System or the NIKE-HERCULES ATBM System during an engagement, full responsibility for tactical control is assigned to a battery control officer. Tactical control is facilitated by placing controls, indicators, and plotting boards required for direction of the system at the disposal of the battery control officer. These controls, indicators, and plotting boards are located in the trailer mounted director station. The battery control officer must assume the eight responsibilities described in paragraphs 59 through 66 below. When the system is operating in integration with the Army Air Defense Command Post (AADCP), the AADCP provides tactical control for the defense area and designates targets, missions, and missiles.

59 (U). Determination and Establishment of Equipment Status

During operation, the battery control officer must have the battery ready to fire as soon as the target is within range. In order to accomplish this efficiently, he must keep informed of the tactical situation and establish the required equipment status at the appropriate time. He determines the required equipment status from information provided by the acquisition radar displays and the plotting boards. He establishes the required equipment status by means of controls on the battery control console.

Equipment status lights indicate to each operator the prevailing equipment status.

60 (U). Selection of Targets for Engagement

The battery control officer evaluates the threat to the defended area and assigns priority to the targets to be engaged. The battery control officer continuously surveys the tactical situation on the plan position indicator (PPI) or PPI's. When the battery operates under the direction of remote AADCP control, the battery control officer interprets the AADCP symbols on the PPI and assigns the target to be designated. In the event that several Improved NIKE-HERCULES Systems are emplaced with overlapping defense areas, the selection of targets is coordinated to realize the total firing capability.

61 (C). Identification of Targets

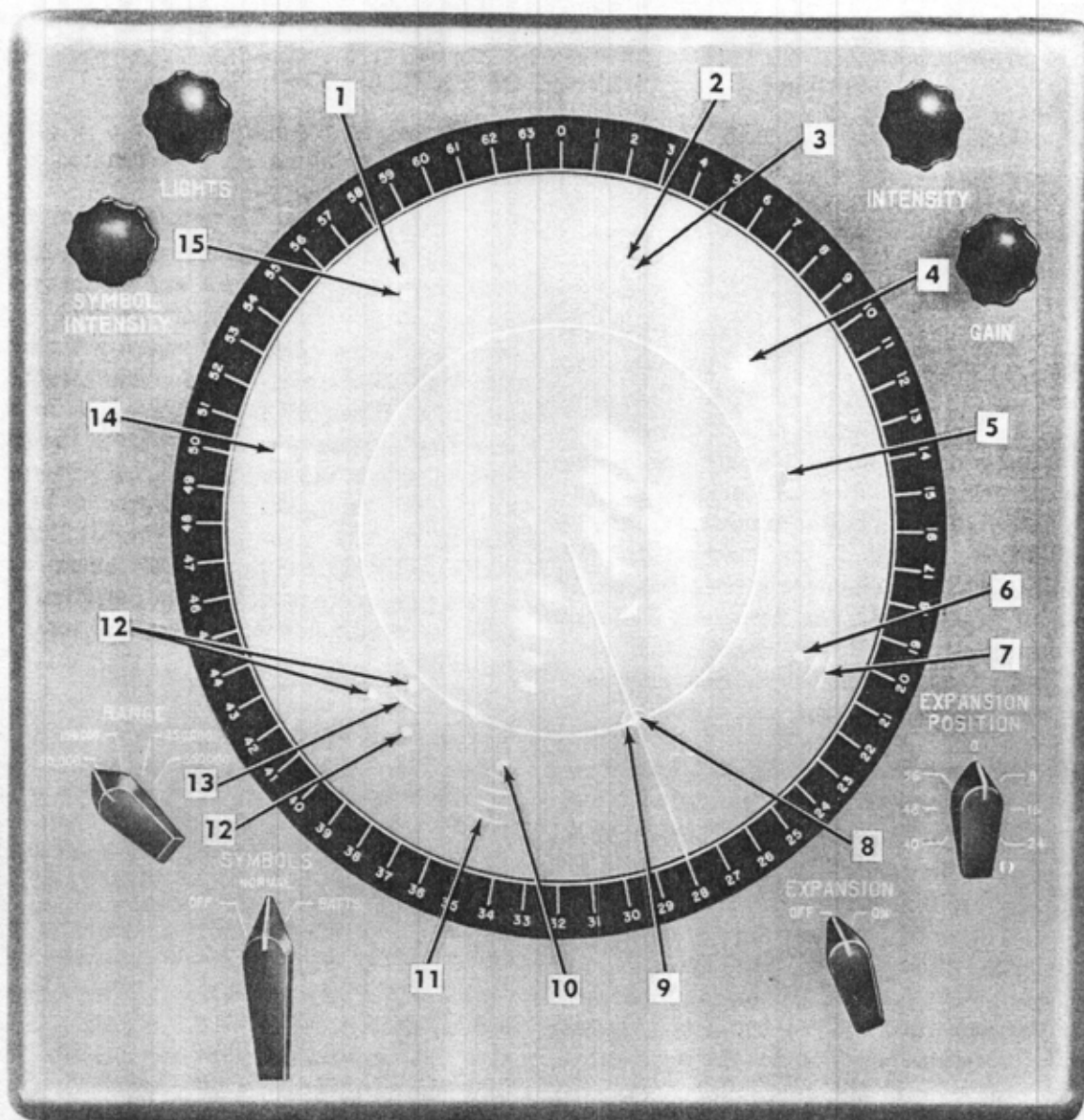
Note. The key numbers shown in parentheses in *a* and *b* below refer to figure 53 except where otherwise indicated.

Note. The AADCP and SIF/IFF symbols which appear on the PPI's in the NIKE-HERCULES ATBM System are identical to the symbols which appear on the PPI in the IMPROVED NIKE-HERCULES System. The PPI's however differ in appearance.

a. AADCP Identification. When the Improved NIKE-HERCULES System is operated in conjunction with the Missile Master System, identification of acquisition radar return signals is made automatically for the battery control officer by means of

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- 1- IFF mode symbol (SIF/IFF)
- 2- Friend symbol
- 3- Return signal
- 4- Battery engagement symbol
- 5- Battery ground position symbol

- 6- Return signal
- 7- PI mode symbol (SIF/IFF)
- 8- Return signal
- 9- Designated target symbol
- 10- Return signal

- 11- Emergency mode symbol (SIF/IFF)
- 12- Return signals
- 13- FLI mode symbols (SIF/IFF)
- 14- Return signal
- 15- Return signal

Figure 53 (C). PPI display—SIF/IFF and AADCP symbols (U).

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| AADCP symbols appearing over the return signal on the PPI. The battery control officer interprets the AADCP symbols, selects a target, and directs the acquisition radar operator to designate the target to the target tracking operators. An upper semicircle appearing over a return signal on the PPI is a friend symbol (2) and indicates that the return signal is from a friendly aircraft. A 330-degree arc is the battery ground position symbol (5). When a target is assigned to the battery for engagement, the battery ground position symbol moves over the return signal (8) of the designated target. The 330-degree arc is then the designated target symbol (9). When another battery is assigned a target, a defocused spot appears over the return signal of the target as the battery engagement symbol (4). Identification of targets is also provided by information supplied to the early warning plotting board operator by the Missile Master System.

b. *SIF/IFF Identification.* The battery control officer may instruct the acquisition radar operator to interrogate an unidentified aircraft, using the selective identification feature/identification friend or foe (SIF/IFF) equipment associated with the acquisition radar systems. The SIF/IFF interrogation is used only when other sources of identification are not available. The battery control officer has the responsibility of deciding whether the aircraft is friendly or hostile. If the correct response is received from the aircraft after SIF/IFF interrogation, a symbol appears on the PPI adjacent to the return signal of the interrogated aircraft, indicating that the aircraft is friendly. If the symbol does not appear on the PPI, the aircraft is considered hostile. If the battery control officer should subsequently determine a target to be friendly, he can manually cancel the engagement at any time before intercept. Because it is possible that a hostile aircraft carrying IFF equipment and employing passive countermeasures could transmit the proper response signals, the battery control officer must use every available means to identify the aircraft correctly. The four modes of SIF/IFF

interrogation are described in (1) through (4) below.

- (1) *IFF mode.* The identification friend or foe (IFF) mode is intended for general use and is used except when a definite need arises for using one of the other modes. When an unidentified aircraft is interrogated in the IFF mode and responds correctly, a single line appears on the PPI as the IFF mode symbol (1) adjacent to the return signal (15) of the interrogated aircraft.
- (2) *PI mode.* The personal identification (PI) mode requires a more complex response from the interrogated aircraft and thereby increases the difficulty for an enemy aircraft to respond correctly. When an unidentified aircraft is interrogated in the PI mode and responds correctly, two parallel lines appear on the PPI as the PI mode symbol (7) adjacent to the return signal (6) of the interrogated aircraft.
- (3) *FLI mode.* The flight leader identification (FLI) mode enables one aircraft in a group of aircraft to respond for the entire group. When a group of aircraft is interrogated in the FLI mode and the correct response is received, a single line appears on the PPI as the FLI mode symbol (13) adjacent to one of the return signals (12) of the interrogated group of aircraft.
- (4) *Emergency mode.* The emergency mode is employed when the most positive identification is required. The emergency mode consists of the other three SIF/IFF modes used simultaneously. When an unidentified aircraft is interrogated in the emergency mode and responds correctly, four parallel lines appear on the PPI as the emergency mode symbol (11) adjacent to the return signal (10) of the interrogated aircraft.

62 (U). Designation of Target

a. In the Improved NIKE-HERCULES System, the target selected for engagement is verbally designated by the battery control officer to the acquisition radar operator. The acquisition radar operator, at the proper time, signals the three tracking radar operators to acquire and track the target. When the target is being tracked, the target tracked signal is sent to the battery control console.

b. In the NIKE-HERCULES ATBM System, after the target has been acquired, the target is designated to the target tracking radar at the proper time. When the target is acquired and is being tracked, the target tracked signal is sent to the fire control-indicator on the battery control console.

63 (U). Designation of Mission-Warhead Combination

a. In the Improved NIKE-HERCULES System, the battery control officer is responsible for designating missiles of the proper mission-warhead combination. There are two possible missions he can select: surface-to-air and surface-to-surface. There are four possible warheads he can select: A NIKE-AJAX high-explosive warhead, which is the only type used in NIKE-AJAX missiles; a NIKE-HERCULES high-explosive warhead; a small nuclear warhead; and a large nuclear warhead. The battery control officer designates the mission-warhead combination that is appropriate for the target to be engaged. The following combinations of missions and warheads can be designated:

<i>Mission</i>	<i>Warhead</i>
Surface-to-air	NIKE-AJAX high-explosive
	NIKE-HERCULES high-explosive
	NIKE-HERCULES small nuclear or
	NIKE-HERCULES large nuclear

*Mission**Warhead*

Surface-to-surface	NIKE-HERCULES small nuclear or NIKE-HERCULES large nuclear
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The destructive power of the nuclear warhead prohibits its use at low altitudes. Before a missile equipped with a nuclear warhead is fired in a surface-to-air mission, the battery control officer directs the computer operator to set into the computer system, minimum burst altitude values that allow the computer system to establish the minimum burst altitude that is safe for the terrain under the predicted intercept point.

b. In the NIKE-HERCULES ATBM System, there are three possible missions: surface-to-air antiaircraft, surface-to-air antimissile, and surface-to-surface. The following combinations of missions and warheads can be designated:

<i>Mission</i>	<i>Warhead</i>
Surface-to-air antiaircraft (A-A)	NIKE-AJAX high-explosive
	NIKE-HERCULES high-explosive
Surface-to-air antimissile (A-M)	NIKE-HERCULES small nuclear or
	NIKE-HERCULES large nuclear
	NIKE-HERCULES high explosive, small nuclear, and large nuclear
Surface-to-surface	NIKE-HERCULES small nuclear or large nuclear

64 (U). Firing of Missile

Probably the most important responsibility of the battery control officer is the firing of the missile. Tactical signal lights and the horizontal and altitude plotting boards provide the battery control officer with the information necessary to determine the proper time to fire. The tactical signal lights indicate that events to be performed prior to firing have been accomplished. The horizontal plotting board indicates the range and azimuth of the target and the

predicted intercept point. The altitude plotting board indicates approximately how much time remains for an intercept, and the altitude of the predicted intercept point. The battery control officer issues the fire signal to the launching area at the optimum time to fire.

65 (U). Monitoring of Fired Missile

After firing, the battery control officer monitors the position of the missile and target from displays on the horizontal and altitude plotting boards. By monitoring the missile and target positions, the battery control officer can determine whether or not the missile is on an intercept course. Missile and target altitude data from the altitude plotting board also provide the battery control officer with the data neces-

sary for observing safety requirements. Due to the destructive power of a nuclear warhead, the course of a missile with a nuclear warhead must be continuously monitored on the altitude plotting board. The minimum burst altitude circuit in the computer system may not protect areas that have higher ground elevation than the area under the predicted intercept point. Transmission of the burst order is initiated manually by the battery control officer if safety requirements warrant.

66 (U). Reports of Completed Engagement

Upon completion of an engagement, the battery control officer assesses the results and advises the Army Air Defense Command Post (AADCP) of the degree of success attained.

Section II (C). SEQUENCE OF EVENTS

67 (U). General

Equipment status determines the actions of operating personnel and the degree of readiness of the Improved NIKE-HERCULES System or the NIKE-HERCULES ATBM System to fulfill its mission. Three degrees of equipment status are used: white, blue, and red. Each status is designated by white, blue, and red indicator lights, respectively. Three lights at the various operating locations throughout the system indicate the prevailing equipment status established by the battery control officer. Yellow equipment lights and associated circuits are provided in addition to the white, blue, and red status lights; however the yellow equipment status is not used. If the battery control officer changes the status, a gong sounds at the target radar control console to indicate that the prevailing equipment status has changed. Paragraphs 68 and 70 describe the sequence of events that occur in normal operation of an Improved NIKE-HERCULES System during each degree of equipment status for a surface-to-air mission and a surface-to-surface mission or of a NIKE-HERCULES ATBM System during each degree of status for a surface-to-air anti-aircraft (A-A), surface-to-air antimissile (A-M) or surface-to-surface missions. Paragraph 71 describes emergency operating pro-

cedures associated with the tactical control circuits.

68 (C). Surface-to-Air Mission

Note. The operation of the NIKE-HERCULES ATBM System during a surface-to-air antiaircraft or anti-missile mission is essentially the same as the operation of the Improved NIKE-HERCULES System during a surface-to-air mission.

a. White Equipment Status.

- (1) White equipment status is a low-voltage condition for the Improved NIKE-HERCULES System. This status permits partial operation or warmup of the equipment. Such a status is advantageous because it permits the system to be constantly ready for an immediate advance to a higher tactical status and eliminates the necessity of keeping the equipment fully operational at all times, thereby greatly reducing equipment wear.
- (2) Activity of the operators in the battery control area during white equipment status is largely confined to recording information received by telephone or other means associated with early warning facilities. This information is manually plotted on the early warning plotting board. When early warning facilities are not available to permit a warning of 30 minutes or more, the

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acquisition radar system is energized from the standby condition to operate condition. The early warning information is then obtained from the display on the PPI or PPI's.

- (3) During white equipment status, performance checks are made on the missiles in the launching area to determine that the missiles are operational.

b. Blue Equipment Status. Blue equipment status is the "preparing to fire" status and is initiated by the battery control officer. At this time identification of the target is unknown. When blue equipment status is initiated, the events in (1) through (15) below occur.

- (1) All white equipment status lights are extinguished and all blue equipment status lights are illuminated throughout the system.
- (2) A gong sounds at the target radar control console to indicate the change in equipment status. The target tracking operators energize the target tracking radar system to the operate condition.
- (3) A siren is energized by the battery control officer to signal all personnel in the battery control area to man their positions.
- (4) A siren, located on the trailer mounted launching control station, is automatically energized to signal all personnel in the launching area to man their positions. At each launching section an alarm buzzer sounds to alert each launching section operator.
- (5) Two communication conference circuits are established. One circuit connects all operating locations concerned primarily with command functions. The other circuit connects all operating locations concerned primarily with technical operations.
- (6) If the acquisition radar systems and associated SIF/IFF equipment have not been previously energized to the operate condition, they are energized from standby to operate as quickly as possible so that targets in the area can be detected and interrogated.
- (7) In the launching area, the launching section personnel place the generators

in operation and prepare one missile at each launcher.

- (8) The flight simulator group on the trailer mounted launching control station is energized and then acquired by the missile tracking radar system. The missile tracking radar system transmits test guidance and burst commands to the flight simulator group to check operation of the missile tracking radar system. Commands received by the flight simulator group are indicated on the launching control console and the launching control console operator relays the indications back to the missile tracking radar operator by telephone.
 - (9) The launching control officer orders all launching sections "on deck" to further prepare for launching in anticipation of a missile request.
 - (10) The acquisition radar operator now interrogates the aircraft that is approaching and, if it is found to be hostile, the battery control officer orders it designated as the target to the target tracking operators.
 - (11) The target tracking operators perform the necessary operations to acquire and track the target.
 - (12) The battery control officer sends a missile and mission request to the launching area. The proper missile is designated by the launching control officer.
 - (13) The designated missile is energized to be ready for launching.
 - (14) Indicator lights at the missile radar control console indicate the selected launching section and the designated missile within the section.
 - (15) The missile tracking radar system locks on the designated missile at the selected launching section.
- c. Red Equipment Status.* Red equipment status is the "firing" status and is initiated by the battery control officer. When red equipment status is initiated, the events in (1) through (15) below occur.
- (1) All blue equipment status lights are extinguished and all red equipment

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status lights are illuminated throughout the system.

- (2) A gong sounds at the target radar control console to indicate the change in equipment status.
- (3) Deleted.
- (4) Gyro azimuth circuits from the computer system to the designated missile are energized so that a roll amount gyro in the missile can be oriented on the predicted intercept point determined by the computer system. The designated missile is now ready for firing.
- (5) The multichannel data recorder in the recorder group begins to record tactical data.
- (6) Four seconds after the target tracked signal is received, the computer system solves the intercept problem and issues a ready to fire signal.
- (7) The computer operator conditions the plotting pens to automatically plot a plan view of the engagement. The altitude plotting board plots the altitude of the predicted intercept point against time of flight. The horizontal plotting board plots the azimuth and ground range coordinates of the target and the azimuth and ground range coordinates of the predicted intercept point.
- (8) The battery is now ready to fire. The battery control officer determines the appropriate time to fire, then actuates the fire switch at the battery control console. A fire signal is sent to the target radar control console, the missile radar control console, the launching control console, and the designated launching section. Simultaneously, firing buzzers sound for 2 seconds at the launching control console and at the Hercules launching section control-indicator in the designated launching section.
- (9) Two seconds after the fire command is received at the launching control console, the launch order is automati-

cally generated, and one-fourth second later, the missile rocket motor cluster is ignited.

- (10) The missile now leaves the launcher. Approximately 1 second later, the computer system senses "missile away" and a missile launch signal is transmitted to the battery control console, the target radar control console, and the missile radar control console.
- (11) Fire circuits at the launching area are now deenergized and the battery control officer selects the type of missile for the next firing. In preparation for the next mission, the launching control console operator selects another section which has a ready missile designated.
- (12) Immediately after the missile is launched, plotting of the azimuth and ground range of the predicted intercept point is discontinued at the horizontal plotting board and a plot of the present missile position begins. Simultaneously, at the altitude plotting board, the plot of altitude of the predicted intercept point is discontinued and a plot of the target altitude against time to intercept begins. In addition, a plot of the missile altitude against time to intercept begins.
- (13) Approximately five seconds after the missile is launched, the computer system evaluates target and missile position data and sends steering orders by way of the missile tracking radar system to the missile to guide it to the target intercept point.
- (14) At a predetermined time before zero time to intercept, the computer system sends the burst order to the missile.
- (15) After completion of the mission, the missile track radar antenna automatically slews to the next designated missile. The equipment status either remains in the red condition to fire again immediately or is returned to the blue condition.

69 (Deleted).**70 (U). Surface-to-Surface Mission**

The surface-to-surface mode of operation is used against fixed ground targets. The sequence of events during white equipment status is the same as for the normal surface-to-air mission (par. 68). Blue and red equipment statuses are established by the battery control officer in the same sequence as for the normal surface-to-air mission. The events occurring during each status that are different from those occurring during a normal surface-to-air mission are described in *a* and *b* below.

a. Blue Equipment Status.

- (1) The battery control officer selects the surface-to-surface mission which automatically identifies the target as hostile and designates the appropriate nuclear warhead.
- (2) Since a NIKE-AJAX missile is never used in a surface-to-surface mission, the launching control officer orders only a NIKE-HERCULES launching section to prepare a missile.
- (3) Launching section personnel condition the missile command burst circuits so that the normal burst order is used by the missile as an arming signal and burst occurs at the desired altitude.
- (4) Elevation, azimuth, and range coordinates are manually set into the target tracking radar system.
- (5) The guidance cutoff switch at the missile track antenna-receiver-transmitter group is adjusted so that the burst order which causes guidance cutoff occurs at the correct time.
- (6) Values derived from firing tables pertaining to the displaced aiming point altitude, and to the time of initiating the final dive are set into the computer system.

b. Red Equipment Status.

- (1) The battery control officer makes a

last minute check of the coordinates of the target, as corrected from the firing table, set into the target tracking radar system.

- (2) The battery control officer checks the target position and displaced aiming point on the horizontal and altitude plotting boards. If the points check, the battery is ready to fire.
- (3) After the missile is launched, missile guidance is maintained in the same manner as for the normal surface-to-air mission until the burst order is transmitted by the operation of the guidance cutoff switch of the missile tracking radar system. The burst order removes ground guidance, disarms the fail-safe mechanism, arms the barometric fuze, and rolls the missile 180 degrees.
- (4) The missile follows a vertical trajectory to the preset burst altitude where the missile bursts.

71 (U). Emergency Operating Procedures

a. General. When normal transmission of tactical control signals between areas or within an area is disrupted, the battery control officer still directs the overall operation of the Improved NIKE-HERCULES battery. If cables are damaged, he verbally transmits commands through the command hot loop supplemented by the technical hot loop of the voice communications system. If telephone lines are damaged, the voice communications system is switched to radio. Both hot loops are automatically established when equipment status is designated as blue or red.

b. Local Setting of Equipment Status. The battery control officer notifies an operator at the target radar control console, who is connected to the command hot loop, of the status change. He also orders the launching control officer to locally establish the equipment status. The launching control officer notifies each launching section operator to manually set the

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status for his section. The status is then passed along to each individual launcher.

c. *Local Designation During Blue Equipment Status.* When notified to change to blue equipment status, the launching control officer orders the operators of the selected launching sections to place their sections "on deck". The battery control officer notifies the launching control officer to designate locally the missile and mission request.

d. *Local Designation During Red Equipment Status.*

- (1) When notified of change to red equipment status, the launching control officer notifies the operator at the pertinent launching section that his section is selected for launching. Then the launching control officer notifies the missile tracking radar operator which section is selected and which launcher designated. The missile track operator manually acquires the missile. The launching section operator locally energizes the missile designate circuits. The missile tracking radar operator is notified to energize missile ready circuits.
- (2) Gyro azimuth data is verbally given by the computer operator to the launching section operator every 10 seconds while the missile is still on the launcher. The launching section operator, through controls at his position, sets in this gyro azimuth data until the missile is fired.
- (3) The fire command initiated by the battery control officer is normally trans-

mitted through cables from the battery control console to the trailer mounted launching control station and then to the section launching the designated missile. During an emergency, the battery control officer closes his fire switch and verbally issues the fire command to the launching area. The launching control officer closes his manual fire switch which automatically fires the designated missile. If cables in the launching area are damaged, the launching section operator, on orders from the launching control officer, closes his fire switch, launching the designated missile.

- (4) Normally the launch order is automatically transmitted through the launching control console to the missile 2 seconds after the fire command. In an emergency, the launching control officer can transmit the launch order manually. At the designated launching section, the operator can also issue the manual launch order at the command of the launching control officer.
- (5) At 1.3 seconds after the missile liftoff, the computer system responds to the upward acceleration of the missile and transmits a missile launched signal to the battery control console, to the target radar control console, and to the missile radar control console. The missile launched signal is indicated at these consoles regardless of the condition of the interarea cables.

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Section III. COMMUNICATION**72 (U). General**

Communication between various locations in the Improved NIKE-HERCULES System is accomplished by means of a voice communication system. This system provides communication facilities under both normal and emergency conditions. The system consists of a telephone system, an intercom system, and an emergency communication system.

73 (U). Functional Description of the Telephone System

a. The telephone system provides service among all stations in the battery control and launching areas. If desired, the telephone system can provide telephone communication with areas outside the Improved NIKE-HERCULES System.

b. The telephone system consists of two switchboard networks. One network connects telephone stations in the battery control area and the other network connects telephone stations in the launching area. Each network includes a manually controlled telephone switchboard with facilities for 29 telephone lines. The switchboard for the battery control area is in the trailer mounted director station. The switchboard for the launching area is in the trailer mounted launching control station.

c. For normal operation during white equipment status, all telephone stations in both areas are connected into one overall switchboard-controlled administrative system. Also, the three cable trunk lines and the three alternate field wire pair trunk lines between the areas are available for routing calls between the battery control area switchboard network and the launching area switchboard network.

d. During blue or red equipment status, the overall administrative system is divided into three tactical systems. Two of these are conference hot loops known as the command hot loop and the technical hot loop. The other is the administrative circuits not on the hot loops. Two of the three cable trunk lines are used for the hot loops. The other cable trunk line is retained for the administrative circuits.

- (1) The command hot loop consists of telephone stations primarily concerned with the command functions associated with firing the missile. These telephone sta-

tions are disconnected from their respective telephone switchboards to form a system of simultaneous communication.

- (2) The technical hot loop consists of telephone stations primarily concerned with the technical operations associated with firing the missile. These telephone stations are disconnected from their respective telephone switchboards to form a system of simultaneous communication.

- (2.1) Certain telephone stations can be switched into either hot loop. The trailer mounted director station, the trailer mounted tracking station, the trailer mounted launching control station, and the launching sections each contain one section of this type.

- (3) The administrative circuits consist of all the telephone stations that remain under switchboard control during blue or red equipment status. These are the telephone stations not connected in either hot loop.

74 (U). Functional Description of the Intercom System

a. The intercom system provides independent voice communication between each Hercules launching section control-indicator and the four associated launchers. This enables the operator at the control-indicator to speak to all launcher personnel within the section simultaneously, and the speech of any launcher personnel may be heard by the operator at the control-indicator.

b. The intercom equipment for each launching section consists of a master station in the Hercules launching section control-indicator and substations at each launcher.

75 (U). Functional Description of the Emergency Communication System

a. The emergency communication system provides emergency communications during blue or red equipment status in case of damage to the three cable trunk lines of the telephone system or to the lines between the telephone switchboard in the trailer mounted launching control station and the launching sections.

b. The emergency communication system consists of the three alternate field wire pair trunk lines associated with the telephone system, four radio sets, and two emergency field wire pairs for each launching section. These are described in (1) through (3) below.

(1) *Alternate field wire pair trunk lines.* Three alternate field wire pair trunk lines, located some distance away from the cable trunk lines of the telephone system, connect the telephone switchboard in the battery control area to the telephone switchboard in the launching area. In case of damage to the cable trunk lines of the telephone system, the alternate field wire pair trunk lines provide trunk line connections for the command hot loop, the technical hot loop, and the administrative circuits.

(2) *Radio Sets.* During blue or red equipment status, two independent radio channels provide communication between the battery control area and the launching area when both the cable trunk lines of the telephone system and the alternate field wire pair trunk lines become

inoperative. Each channel has a radio set in the battery control area and the launching area. The radio command hot loop channel provides a communication link for all telephone stations on the command hot loop and terminates at each telephone switchboard. The radio technical hot loop channel provides a communication link for all telephone stations on the technical hot loop and terminates at each telephone switchboard. Under these conditions the administrative telephones in the battery control area cannot communicate with the administrative telephones in the launching area.

(3) *Emergency field wire pairs.* During blue or red equipment status, two emergency field wire pairs for each launching section provide communication between the launching sections and the radio sets in the launching area when normal telephone lines between the launching sections and the telephone switchboard in the launching area become inoperative.

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